

Report

EU BASIN Kickoff Meeting, Copenhagen, Denmark

February 22-25, 2011,

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Summary

It has been well understood that the North Atlantic plays critical roles in climate change through thermohaline circulation, carbon export and transport–dispersion of marine plankton–fish populations, and in social economics through marine resources management and utilization. A systematic study of coupled natural and human processes in North Atlantic is needed for developing ecosystem based management and governance of marine resources protection and usage. At this North Atlantic basin scale, this study can be achieved only through international partnerships in research and education. The international BASIN Program has provided an opportunity to integrate scientists and students from North America and Europe into a coordinated systematic study and education on coupled natural and human processes in the North Atlantic, which is highly endorsed by the European Commission (EC).

The EU kickoff meeting was held between Feb 22 and 25 in Copenhagen. The objective was for EU BASIN participants to review proposed tasks and to develop detailed plans for their proposed tasks and deliverables. The meeting included:

- An overview of tasks and deliverables for each Work Package (WP)
- Canadian BASIN Status (Pierre Pepin) and the US BASIN North Atlantic Implementation Plan (Meng Zhou)
- Individual WP meetings to discuss detailed research plans
- Mixed WP group meetings to discuss linkages and integrations between WPs
- Plenary discussion on individual and mixed WP reports, planned cruises, experiments, integration between measurements and models, and publications.

The focused areas based on individual and mixed WP are:

- Retrospective study from biogeochemical processes, zooplankton–fish, to economics
- Biological carbon pump, and carbon flow in trophic levels
- Role of mesozooplankton and fish in ecosystems, foodwebs and carbon pump
- In situ and modeling studies of foodwebs and ecosystems in regional seas
- Zooplankton and fish vital rates (grazing, growth and mortality)
- Models from export algorithms, physiology, foodwebs, habitats and end-to-end
- Data management and service, workshops and student training

The representative from EC gave a presentation emphasizing:

- EC priorities on ecosystem based resource and maritime management and governance
- New funding mechanism to fund marine projects by combining EC and national grants

It is clear that 7 million euros from EC contribute a small fraction of the total cost needed to accomplish the tasks and deliverables proposed in the EU-BASIN project. To enhance this EU-BASIN project, Iceland has committed a regional cruise for Iceland Shelf–Basin, Norway has committed a regional monitoring program on Norwegian shelf–shelfbreak and an transatlantic cruise, and Germany has committed a winter convection cruise and proposed an transatlantic cruise, all of which have added additional 10-20M euros. Even though at the present commitments, to meet the BASIN goals the EU participants must find:

- Additional funding from their national agencies for supporting personnel time, equipment, sensors and material supplies
- Support from US for scientist to participate in fieldwork and modeling by providing scientific insights, technical support and ship time for covering different geographic areas and seasons and for addressing BASIN-related scientific questions.

1. Highlights

The EU ship opportunities, participating institutions, leading PIs of WPs and relationships between WPs can be found in Appendixes 1-4.

1) EU BASIN cruises

Four cruises are discussed open to US and Canadian participation:

- 2012 German deep-convection cruise (Mar 13–April 27, funded and led by Mike St John):
Focus: Export of winter assemblage after winter convection stops
- 2013 UK PAP cruise (Spring, funded and led by Richard Sanders)
Focus: Mesoscale carbon export and role of grazing and migration of mesozooplankton and midwater fish
- 2013 Norwegian transatlantic cruise (Spring-summer, funded and led by Webjørn Melle)
Focus: Geospatial differences in physical processes, nutrient regimes, plankton-fish community structures, carbon export and population genetics
- 2013 German transatlantic cruise (Spring-summer, requested and led by Mike St John)
Focus: Geospatial differences in physical processes, nutrient regimes, plankton-fish community structures, carbon export and population genetics

Note: *A US transatlantic cruise was requested by EU colleagues for either 3 ship operation in spring 2013, or 3 seasons (spring, summer and fall) to address basin scale processes. The transatlantic cruise is planned to run between Norwegian shelf and North American shelf. If the US cannot participate, an alternative cruise plan was discussed redesigning transatlantic transects between Norwegian shelf to Greenland shelf by focusing on European shelves and seas.*

2) Regional comparative studies and end-to-end models

Cruises in Greenland, Iceland and Norwegian shelf and seas are discussed specifically for foodweb, biodiversity and end-to-end model development. These cruises are composed of already planned monitoring programs for fisheries and plankton-fish communities, and specifically requested cruises (Iceland cruise). These cruises are generally fully-booked in berths, laboratories and ship time. In addition, there are existing studies in the Bay of Biscay and North Sea. The comparative study of foodweb structures, diversity and models of foodwebs and end-to-end in regional shelves, slopes and seas is one of primary BASIN focuses.

Note: *Adding studies in North American shelves, slope and seas will significantly expand the geographic coverage of the BASIN study region, and allow a comparative study of shelves and regional seas crossing the entire North Atlantic. This also provides an opportunity for US scientists and students to be involved into North Atlantic regional comparative study of climate impacts on ecosystems, fisheries, and social economics.*

3) Model development

The model development in the EU BASIN is broad from biogeochemical process, ecosystem, foodweb, to end-to-end models:

- Export algorithms: The generation 1 and 2 models are suffering from the variation of scavenging processes how fast POC is remineralized as a function of depth. The Southampton group is going to conduct retrospective study to summarize literature value and produces a new formula.
- 3-D hydrodynamic and ecosystem models: The NEMO framework is adapted by the EU-BASIN. The results of these models will be provided online for all BASIN participants including scientists from North America. Scientists can build their work

on NEMO framework and results or in parallel.

- Foodweb carbon or nitrogen (fish) model for regional seas: Bayesian-statistics based 1-D vertical model for the North Sea has been developed. The advantage using Bayesian statistics is to compute probability function and compute variance and correlations between state variables by considering uncertainties in measurements.
- Spatial and temporal explicit end-to-end models: End-to-end model has been developed and will be refined during the project- which is the primary cause for this project to be funded, or the interests of EC. It has been emphasized and linked with all WPs from carbon export to fisheries.

Note: *This EU BASIN project is funded under the primary objective to develop foodweb and end-to-end models applicable to ecosystem based management and governance. The retrospective analysis, fieldwork measurements and process studies are designed toward developing these models, which provide US scientists an opportunity to join the EU effort developing models needed for protecting and managing our marine resources and economics.*

4) International partnership

The EU BASIN project is supported by EC with the strong international theme to understand the differences in natural and human processes between different seas and countries, the need of international partnerships and the future research and education at the global and international scopes.

Note: *US scientists and students will gain significantly from such international partnerships, not only by international experience working with foreign partners, but also by thinking coupled natural and human processes and using approaches at global and international levels. This will be a golden opportunity for training our next generation of young scientists.*

2. Specific Opportunities

1) 2012 German deep-convection cruise

Ship: RV Meteor

Date: March 13 – April 27, 2012

Chief Scientist: Mike St John

Study Site: Norwegian Sea, Subpolar Gyre and Iceland Sea

Objectives: The cruise focuses on carbon export associated with winter deep convection:

- Deep phytoplankton distribution due to winter deep convection
- Carbon export from winter-phytoplankton settling when winter convection stops
- Spring bloom and carbon export associated with spring bloom assemblages
- Effect of grazing and migration of zooplankton and fish on carbon flow and export

Participants:

- Phytoplankton-microbes and primary production
 - C13-14 primary production (NOCS)
 - Phytoplankton and microbe abundances and assemblages (NOCS)
 - Phytoplankton physiology and fatty acids (UH)
- Mesozooplankton-fish
 - Towed undulating multi-frequency acoustic system-LOPC-VPR (IMR, UH)
 - ROV for phytoplankton, aggregates and zooplankton (UH)
 - LOPCs mounted on the rosette (UN-University of Northland)

- Multiple net (IMR)
- Carbon export: Southampton group
 - Drifting traps (NOCS)
 - Thorium export (NOCS)

Opportunities for US scientists to close the loop:

- Nutrient (trace metals and macronutrients) dynamics
- Size spectra from phytoplankton, microbes to zooplankton
- Zooplankton-fish migration behavior and grazing
- Trophic dynamics based on gut contents, and molecular and isotope technologies
- Data analysis and synthesis (Especially for VPR, LOPC, acoustics data)

2) 2013 UK PAP cruise

Ship: To be decided

Date: Spring 2013

Chief Scientist: Richard Sanders

Study Site: Porcupine Abyssal Plain (PAP) time-series station off southwest Ireland

Objectives: The cruise focuses on carbon export associated with mesoscale physical processes and zooplankton grazing in the mesoscale–resolving mooring array site studying:

- Submeso-mesoscale distribution of phytoplankton responding to mesoscale physics and nutrient dynamics
- Impacts of nutrients on phytoplankton assemblages and carbon export
- Effect of grazing and vertical migration of zooplankton and fish on carbon export

Participants:

- Phytoplankton-microbes and primary production
 - C13-14 primary production (NOCS)
 - Phytoplankton and microbe abundances and assemblages (NOCS)
- Carbon export: Southampton group
 - Drifting traps and Thorium export (NOCS)

Opportunities for US scientists to close the loop:

- Nutrient (trace metals and macronutrients) dynamics
- Size spectra from phytoplankton, microbes to zooplankton
- Zooplankton-fish migration behavior and grazing
- Trophic dynamics based on gut contents, and molecular and isotope technologies
- Two ship operation integrating mesoscale survey and process studies

3) 2013 Norwegian and German transatlantic cruises

Ships: RV GO Sars (funded) and RV Meteor (requested)

Date: Spring/summer/fall 2013

Chief Scientist: Webjørn Melle (GO Sars) and Mike St John (Meteor)

Study Site: Transects from the Norwegian Shelf to North American Shelf

Objectives: The cruises are designed to examine spatial and seasonal variability in physical, biogeochemical and biological processes:

- Spatial and temporal variability in mesoscale physical processes (scale and strength) superimposed on large basin–scale hydrography, currents and circulation
- Spatial and temporal variability in nutrient compositions that leads to different

phytoplankton community dynamics

- Differences in plankton community structures responding to spatial variability in physical and biogeochemical processes, and impacts on carbon flow between trophic levels and export
- Transport and dispersion of plankton-fish populations crossing shelves and gyres driven by basin-scale circulation and mesoscale dispersion.

Note: EU colleagues have discussed the need of a US ship participating either a 3-ship operation study simultaneously covering 3 transatlantic transects at different latitudes, or a 3 season (spring/summer/fall) study covering one transatlantic transect. The 3-ship operation study focuses on scientific questions associated with basin scale variability in both the longitude and latitude while the 3-season study focuses on seasonal evolution in meso-basin scale physics, biogeochemical and biological processes.

Participants:

- Phytoplankton-microbes and primary production
 - C13-14 primary production (NOCS)
 - Phytoplankton and microbe abundances and assemblages (NOCS)
 - Plankton physiology and rates (UH)
- Mesozooplankton-fish
 - Towed undulating multi-frequency acoustic system-LOPC-VPR (IMR, UH)
 - LOPCs mounted on the rosette (UN)
 - Multiple net (IMR)
- Carbon export: Southampton group
 - Thorium export (NOCS)

Opportunities for US scientists to close the loop:

- Nutrient (trace metals and macronutrients) dynamics
- Size spectra from phytoplankton, microbes to zooplankton
- Zooplankton-fish migration behavior and grazing
- Water-column and benthic coupling
- Biodiversity
- Trophic dynamics based on gut contents, and molecular and isotope technologies
- Population genetics
- Data analysis and synthesis (Especially for VPR, LOPC and acoustic data)

3. Specific needs from North America

1) Basin scale studies

The EU BASIN project sincerely needs the support from US in both the spatial coverage on meso-basin-scale processes in the northwestern Atlantic and Subpolar Gyre and the scientific collaboration in developing new understandings and models. If there is no US support, the EU BASIN project will be failed at the basin-scale, will become a focused study in European seas only, and will not have any BASIN Phase II funding from EC. Specifically, there is a need for US:

- **To cover scientific topics in the northwestern Atlantic and subpolar gyre.** The Gulf Stream not only transports heat from the southwestern Atlantic to the northeastern Atlantic, but also transports zooplankton-fish populations to invade or mix with local ecosystems while the hydrography and ecosystems in the shelf, shelf slopes and basins in the northwestern Atlantic are impacted by arctic and deep water

outflows and plankton-fish populations. The northwestern Atlantic is a critical link in the entire loop of currents, heat, carbon export and ecosystems in the North Atlantic. Missing the northwestern Atlantic, we break the loop, and fail the BASIN Program.

- **To participate in studies of coupled natural and human processes.** The marine resources and social economics in the North Atlantic are closely coupled by fisheries management, trades and government political and economic policies throughout countries in North America and West-North Europe. The US has the biggest economy in the world. It is essential for the US to understand coupled natural and human processes for sustainable economic and social development. The EU BASIN provides us a golden opportunity to work closely with EU natural and social scientists. Without US participation, we isolate US scientists from international science communities.
- **To form the International BASIN Program.** The US has invested significant efforts in the BASIN Program for years. We should take the recently funded EU BASIN as a compliment to the US vision of basin-scale studies. Engaging and collaborating with EU BASIN Project will allow US scientists to work with EU scientists in parallel. Though the EU BASIN is already funded, they are still facing challenges to obtain supplementary funds from individual countries, sort out personnel needs and negotiate commitments for each member-country. The US NSF system is efficient, of the bests based on proposed sciences. As proposals are funded, scientists can quickly move research activities forward without any need of financial and political supplements so that an integrated US-Canada-EU BASIN project can be formed. But we need to respond now.

2) Advancing science and technology

EU scientists have been closely examining US scientists on emerging scientific questions, and breakthroughs in science and technologies. In the EU BASIN Project, EU scientists have been seeking scientific answers and technologies associated with the EU objectives from US scientists. They have been openly asking assistances in:

- Fast analytical methods for trace metals to resolve mesoscale physical and biogeochemical processes
- Capability to resolve submeso-mesoscale physical, biogeochemical and biological processes, understand their impacts on plankton-fish community evolution and export carbon flux, and parameterize these processes in global models
- Capability to resolve scavenging processes of particular organic carbon (POC), understand their impacts on carbon flux and parameterize these processes in models
- Capability to estimate zooplankton-fish grazing and migration behavior and understand their impacts on carbon redistribution in water column
- Capability to measure plankton-fish community structures and trophic dynamics, understand these processes and develop models for these processes
- Capability to link in situ measurements (especially optical and acoustic sensors) with rate estimates and model development
- Collaboration in developing molecular and isotope methods for prey-predator interaction and trophic dynamics studies
- Comparative analysis between different ecosystem and foodweb models

4. Appendix I. EU Ship Opportunities

Status	Start Date	Region	Chief Scientist	Ship	Cruise Name	Duration (d)	WPs
FUNDED	15-Mar-12	NE Atlantic	Jan Backhaus	METEOR	Deep Convection	42	2, 3, 4, 5
FUNDED	20-Mar-11	West Greenland	Torkel G. Nielsen	Porsild/Field station		42	4
FUNDED	1-Jun-12	West Greenland	Peter Munk	Undecided		42	4
PLANNED	Spring 2013	NE Atlantic	Ricard Lampitt	Discovery/James Cook	PAP NABE	30	2, 3, 4
Submitted	5-Jul-05	Trans-Atlantic	Mike St John	METEOR	From Physics to Fish	45	2, 3, 4, 5
FUNDED	13-Apr-13	Trans-Atlantic	Webjorn Melle	G.O. Sars	From Physics to Fish	45	3
FUNDED	1-Jan-12	NE Norwegian Sea	Webjorn Melle	G.O. Sars	From Physics to Fish	4	3
FUNDED	1-Mar-12	NE Norwegian Sea	Webjorn Melle	G.O. Sars	From Physics to Fish	4	3
FUNDED	1-May-12	NE Norwegian Sea	Webjorn Melle	G.O. Sars	From Physics to Fish	4	3
FUNDED	1-Aug-12	NE Norwegian Sea	Webjorn Melle	G.O. Sars	From Physics to Fish	4	3
FUNDED	1-Nov-12	NE Norwegian Sea	Webjorn Melle	G.O. Sars	From Physics to Fish	4	3
FUNDED	1-Jun-12	Western Norwegian Sea	Webjorn Melle	G.O. Sars	From Physics to Fish	7	5
FUNDED	1-May-13	Western Iceland/North Atlantic	Astthor Gislason	Bjarni Saemundsson	From Physics to Fish	7 to 10	3, 4
FUNDED	1-May-12	Western Iceland/North Atlantic	Astthor Gislason	Bjarni Saemundsson	From Physics to Fish	7 to 10	3, 4
Submitted	1-Aug-13	East Greenland (65-80 ° N)	Andy Visser	Dana	Physical/Biological Oceanography	13	2, 4

5. Appendix 2. EU Participating Institutions

- 1) University of Hamburg UHAM Germany
- 2) University of Bremen UNI-HB Germany
- 3) Danmarks Tekniske Universitet DTU-AQUA Denmark
- 4) FundacionTecnalia-AZTI Tecnalia-AZTI Spain
- 5) Natural Environment Research Council NERC United Kingdom
- 6) Hafrannsóknastofnunin MRI-HAFRO Iceland
- 7) Morski Instytut Rybacki w Gdyni MIR Poland
- 8) Plymouth Marine Laboratory PML United Kingdom
- 9) University of East Anglia UEA United Kingdom
- 10) Aarhus Universitet NERI Denmark
- 11) Havforskningsinstituttet IMR Norway
- 12) Institut français de Recherche pour l'Exploitation de la Mer IFREMER France
- 13) Sir Aister Hardy Foundation for Ocean Science SAHFOS United Kingdom
- 14) Institut pour Recherche le Developpement IRD France
- 15) Centre National de la Recherche Scientifique CNRS France
- 16) University of Strathclyde USTRATH United Kingdom
- 17) The Secretary of State for Environment, Food and Rural Affairs CEFAS United Kingdom
- 18) Høgskolen i Bodø BUC Norway
- 19) University Research Uni Research Norway
- 20) Instituto Espanol de Oceanografia IEO Spain
- 21) Collecte Localisation Satellites SA CLS France
- 22) Swansea University SWANSEA United Kingdom
- 23) Middle East Technical University IMS-METU Turkey

6. Appendix 3. Work Package Leaders



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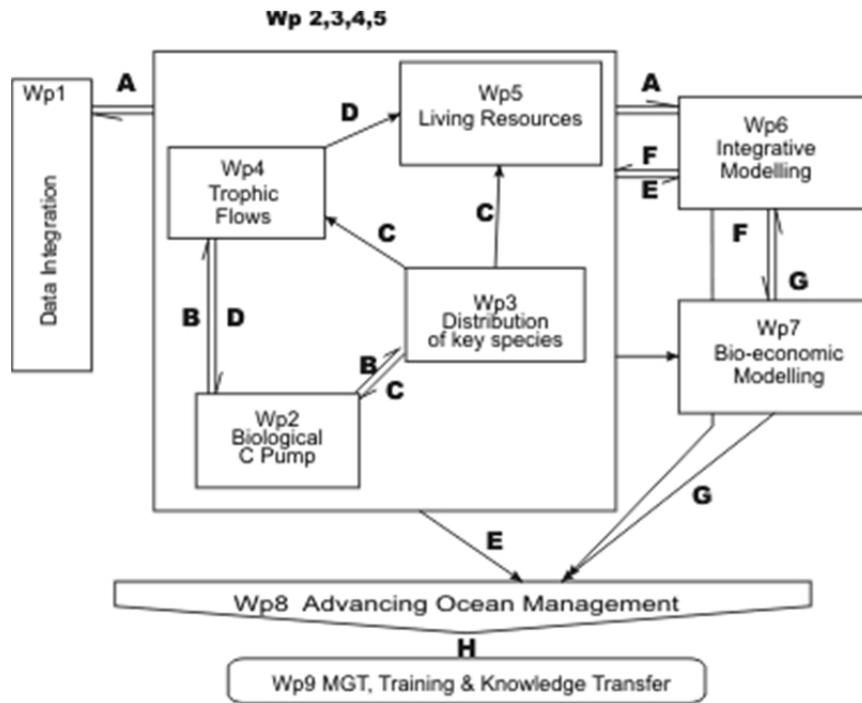


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7. Appendix 4. EURO-BASIN PERT Chart



Letters indicate the links between WPs:

- A. WP1 provides historical data rescue and products for retrospective analysis in WP2-WP5 and modelling WP6; in return WP1 archives all observational data and modelling output.
- B. WP2 will provide retrospective analysis (input from WP1) and generate new observations (see Section 'B2.4 Resources to be committed' for EURO-BASIN dedicated field campaigns) on lower trophic levels ecosystem structure for habitat mapping (input to WP3) and constraining physiological vital rates and improved particle flux modelling (collaboration with WP4 and 6)
- C. WP3 will provide retrospective analysis (input from WP1) and develop geographic habitat maps within which vital rates will be better constrained (WP4). WP3 will also provide prey fields for those key habitats to feed into WP5 and for basin-scale modelling in WP6.
- D. WP4 will constrain key trophic flows (in collaboration with WP2) within the key habitats identified (WP3). WP4 will provide prey fields vital rates to WP5 and enhanced modelling parameterisation for WP6.
- E. WP5 will use prey fields input, in terms of biogeography (WP3) and physiology (WP2 & 4), as well as retrospective analysis (WP2-5) and assess the dynamics of exploitable living resources under climate and anthropogenic pressure. WP2-5 provide ecosystem and key species indicators to WP6,7 & 8;
- F. WP6 will simulate changes in ocean carbon storage, habitat evolution and dynamics exploitable resources under impact of climate and anthropogenic pressure, to test the effect of fisheries management strategies on biogeochemical cycling and the biological carbon pump (WP2-5).
- G. WP7 will estimate the economic cost of sub-optimal basin-scale North Atlantic fisheries management and develop a bio-economic model of fish commodities linking supply (ecosystem) and demand (exploitation). WP7 feeds input to WP8 and receives simulation output from WP 6 and validation data from WPs 1-5.
- H. WP8 Advancing Ocean Management integrates observational and retrospective analysis (WP2-5) and biogeochemical and ecosystem indices (WP6) to assess the basin-scale applicability of EC management measures and directives (e.g. Common Fisheries Policy, Marine Strategy Framework Directive) as well as provide scientific recommendations.